

Consolidated Program for Research and Development for Welding of High Strength Steel Pipelines, #277 & 278

PUBLIC PAGE

QUARTERLY REPORT

Project WP#278: Development of Optimized Welding Solutions for X100 Line Pipe Steel

For Period Ending: February 28, 2009

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Background

To meet the increasing demand for energy in North America, oil and gas reserves in more remote and challenging regions are being developed where large volumes of natural gas will be transported by new long distance, high pressure transmission pipelines. Advanced pipeline designs utilizing high strength line pipe is a key element in meeting these increasing energy demands. A significant amount of laboratory research has been conducted on the development of X100 line pipe and associated welding technology; including, a few recent demonstration projects of limited size and scope. Accordingly, there are few welding process options proven for X100 and the knowledge resides within a small number of companies. The objectives of the proposed work are to establish the range of viable welding options for X100 line pipe, define essential variables to provide for welding process control that ensures reliable and consistent mechanical performance, validate the new essential variables methodology for relevant field welding conditions, and verify weldment performance through a combination of small and large scale tests. Full implementation will be achieved through changes to applicable codes and standards.

Progress in the Quarter

Project activities undertaken through the sixth quarter focused on (1) State of the Art Review; (2) Identification of Essential Variables; and (3) Fundamental Understanding of Welding Processes and Essential Variables. The work to develop the gap analysis for the welding of high strength steel pipelines is nearing completion.

Joint web-conferences with Project 277 have been held once every two weeks. Mechanical and metallurgical tests on the single-torch girth welds that were completed in June 2008 are well underway.

A second set of girth welds, including single- and dual-torch welds in 1G and 5G positions, were completed in January 2009. Testing of these welds will soon be underway.

Preliminary thermal and microstructure models have been developed specifically for narrow-groove pipe girth welding of high strength steels. Initial comparison with prior experimental data showed that the models provide reasonable accuracy. The models are being exercised against the thermal and microstructure measurements of the first round of welds made in this project.

Three X100 line pipe steels have been selected for HAZ simulation studies; including evaluation of continuous cooling transformation (CCT) behavior of the grain coarsen (GC) HAZ regions as a function of cooling time. Further detailed evaluation of simulated HAZ structure and properties is also underway. A selection of multipass welds is being used to generate transformation data for a range of weld metal chemistries.